

An overview on Air Powered Vehicle

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ABSTRACT: Light utility vehicles are becoming very popular means of independent transportation for short distances. Cost and pollution with petrol and diesel are leading vehicle manufacturers to develop vehicles fueled by alternative energies. Engineers are directing their efforts to make use of air as an energy source to run the light utility vehicles. Here we used AIR as a fuel to run the automobiles. As air is free to us and renewable source of energy and most reliable too. In this we used Air for intake and also we used carbon filter for removing the dust particles. For this we don't need petrol or diesel, we can directly run engine by air. The use of compressed air for storing energy is a method that is not only efficient and clean, but also economical. The major problem with compressed air cars was the lack of torque produced by the "engines" and the cost of compressing the air. Recently several companies have started to develop compressed air vehicles with many advantages and still many serious bottlenecks to tackle. This paper briefly summarize the principle of technology, latest developments, advantages and problems in using compressed air as a source of energy to run vehicles.

KEYWORDS: Pollution, Alternative energy sources, Compressed air.

I. INTRODUCTION

We know that our world is facing fuel crisis now. All kinds of conventional source of fuel for the history of cars becoming more and more expensive and impractical especially from an environment. These factors are leading car manufacture to develop car fuel-cell-powered cars will roll onto the world's highway. Petrol and diesel which have been the main sources of fuel in the history of transportation are becoming more expensive and impractical (especially from an environmental standpoint). Such factors are leading vehicle manufacturers to develop vehicles fueled by alternative energies. When at present level of technological development fuel-less flying (like birds) i.e., flying based on the use of bio-energy and air power in the atmosphere seems to be almost impossible for human beings then engineers are fascinated at least with the enormous power associated with the human friendly as well as tested source of energy (i.e., air) to make air-powered vehicles as one possible alternative. It serves the domestic and industrial purposes. Compared to batteries compressed air is favourable because of high energy density, low toxicity, fast filling at low cost and long service life. To meet the growing demand of public transportation, less pollution consciousness, people are in the search of ultimate clean car with zero emissions. It is hard to believe that compressed air is used to drive the vehicles. However that is true and —air car|| as it popularly knows has caught the attention of research worldwide. MDI (Moteur Development International) is one company that holds the international patents.

II. COMPRESSED AIR TECHNOLOGY:

After twelve years of research and development, Guy Negre has developed an engine that could become one of the biggest technological advances of this century. A French engineer by profession, he has designed a low consumption and low pollution engine for urban motoring that runs on compressed air technology (Figure 2). The CATS (Compressed Air Technology System) "air car" from Motor Development International is a significant step for zero emission transport, delivering a compressed air-driven vehicle that is safe, quiet, has a top speed of 110 km/h and a range of 200 km. Costing next to nothing to run, the Zero Emission Vehicle (ZEV) range - which includes a pick-up truck and van - was released in 2005 Guy Nègre is the head of Research and Development at Moteur Development International (MDI) cars, where the Zero Emission Vehicle (ZEV) prototype has been in production since 1994. The two stroke engine is powered by compressed air stored in tanks at about 150 times the pressure in car tyres. The expansion of the compressed air drives the pistons to create movement, replacing the burning of fossil fuel in a conventional engine. In an air-refilling station (currently unavailable as service stations have not been fitted yet) it is estimated to take between three and four minutes to re-fuel. At home, with a 220V plug, it takes three and a half hours.

The principle of compressed-air propulsion is to pressurize the storage tank and then connect it to something very like a reciprocating steam engine of the vehicle. Instead of mixing fuel with air and burning it in the engine to drive pistons with hot expanding gases, compressed air vehicles (CAV) use the expansion of compressed air to drive their pistons. Thus, making the technology free from difficulties, both technical and medical, of using ammonia, petrol, or carbon disulphide as the working fluid. Manufacturers claim to have designed engine that is 90 percent efficient. The air is compressed at pressure about 150 times the rate the air is pressurized into car tyres or bicycle. The tanks must be designed to safety standards appropriate for a pressure vessel. The storage tank may be made of steel, aluminium, carbon fiber, Kevlar or other materials, or combinations of the above. The fiber materials are considerably lighter than metals but generally more expensive. Metal tanks can withstand a large number of pressure cycles, but must be checked for corrosion periodically. A company has stated to store air in tanks at 4,500 pounds per square inch (about 30 MPa) and hold nearly 3,200 cubic feet (around 90 cubic metres) of air. The tanks may be refilled at a service station equipped with heat exchangers, or in a few hours at home or in parking lots, plugging the vehicle into an on-board compressor. The cost of driving such a car is typically projected to be around Rs. 60 per 100 km, with a complete refill at the "tank-station" at about Rs. 120 only.

III. ENGINE WORKING

- How does air engine work
- Approximately 90m³ of compressed air is stored in fiber tank in the vehicle.
- The engine is powered by compressed air, stored in a carbon-fiber tank at 30Mpa (4500psi). The tank is made of carbon fiber in order to reduce its weight
- The expansion of this air pushes the piston and creates movement. The atmospheric temperature is used to re-heat the engine and road coverage.
- The air conditioning system makes use of expelled cold air.

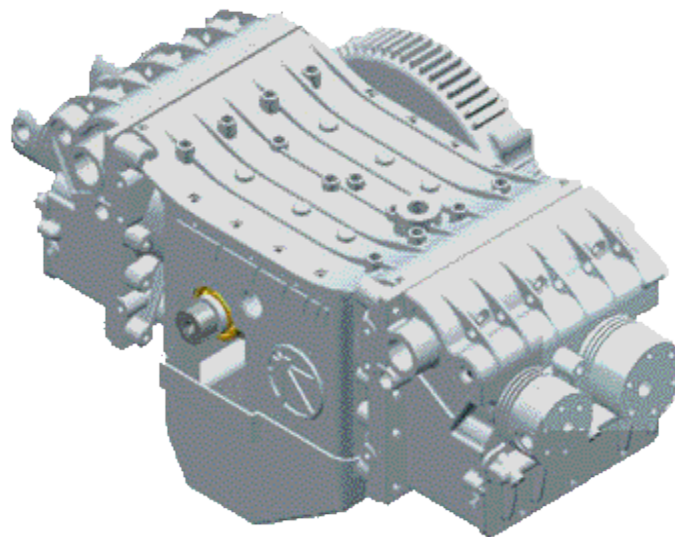


fig1.Air engine

- **How Compressed Air Can Fuel a Car**
- In practical terms compressed air at 300 bars is stored in the carbon fiber tank A. Air is release through the main line firstly to an alternator B where the first stage of decompression takes place. The now cold air passes through heat exchanger C which adds thermal energy to the air and provides a convenient opportunity for air conditioning D.

- The warm compressed air now passes to the motor E where two more stages of decompression and reheating takes place. The motor drives the rear axle G through the transmission F.

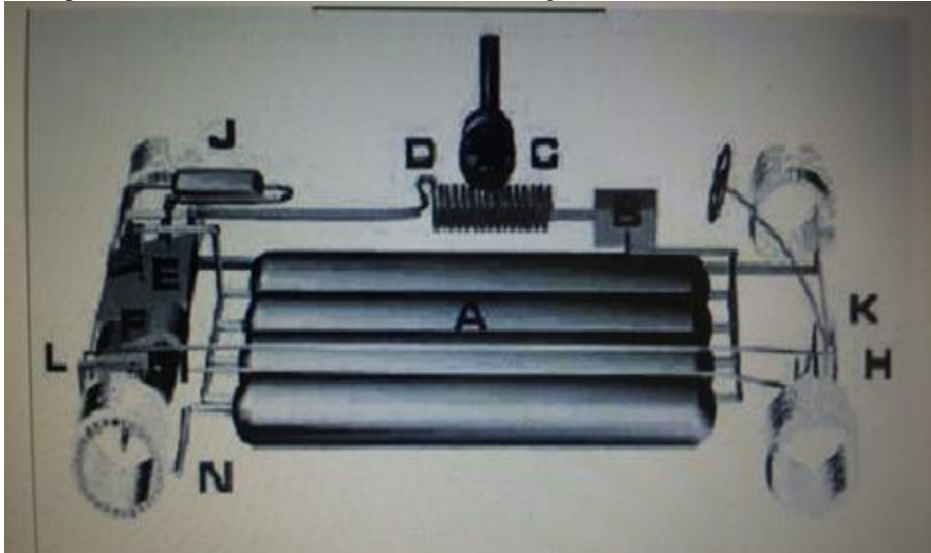


fig2. The Chassis

➤ Compressed Air Tanks

- Compressed air tanks are one of the major part of this car. This tank holds 90 cubic meters of air compressed to 300 bars. It is similar to the tanks used to carry the liquid gas used by buses for public transport. The tanks enjoy the same technology developed to contain natural gas. They are designed and officially approved to carry an explosive product: methane gas.
- It is fitting, that MDI has reached an agreement with the European Leader in aerospace technology air bus industries for the manufacture of the compressed air storage tanks. With a remote supervision arrangement, Air bus industries oversees the making of the storage tanks at each MDI factory. The coiled carbon fiber technology used in the construction of the tanks is complex and requires a substantial quality control process which the multinational company, home of the Airbus aircraft, will provide for our vehicles.

• The Air Filter

- The engines work with both air taken from atmosphere and air pre-compressed in tanks. Air is compressed by the on-board compressor or at service station equipped with a high pressure compressor
- This represents a true revolution in automobiles – it is the first time that a car has produced minus pollution, i.e. it eliminates and reduces exciting pollution rather than emitting dirt and harmful gases. The exhaust pipe on the car produces clean air which is cold on exit (between -15o and 0o) and is harmless to human life.

➤ Process Description

- The first piston takes in ambient air and compresses it to approximately 300 psi and 200 °F in the compression chamber during the first cycle of the engine.
- When the piston pause, a small amount of compressed air from the tanks is released into the expansion chamber to create a low pressure, low temperature volume of about 140psi.
- Shortly before the valve to the exhaust cylinder is opened, a high speed shutter connects the compression and expansion chambers
- The air tanks for storing the compressed air are localized underneath the vehicle. They are constructed of reinforced carbon fiber with a thermoplastic liner. Each tank can hold 3,180 ft³ of air at a pressure of up to 4,300 psi. When connected to a special compressor station, the tanks can be recharged within 3-4 min. They can also be recharged using the onboard compressor 3-4 hours after connecting to a standard power outlet.

Technology Description

- The following is the description of the actual functionality of the motor.

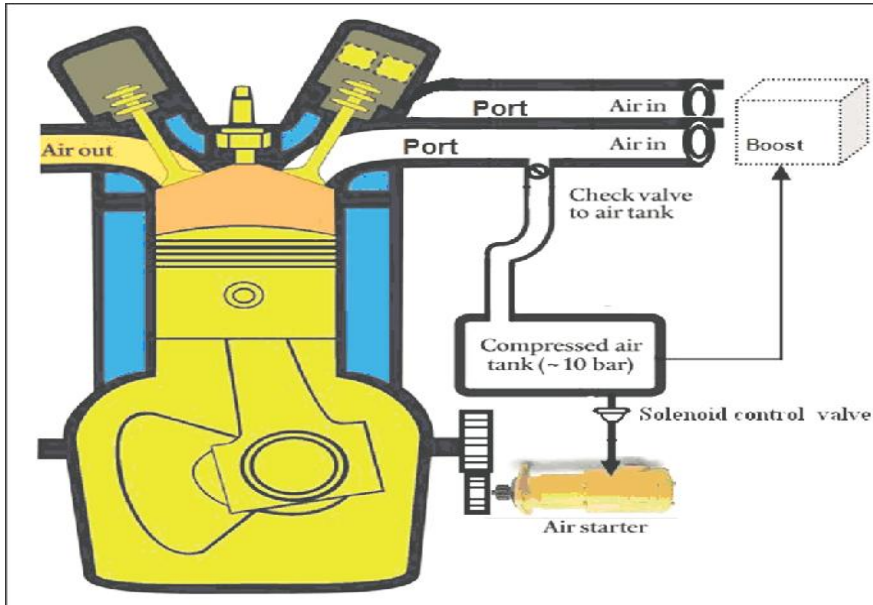


fig.3.Structure of air engine

➤ **Working**

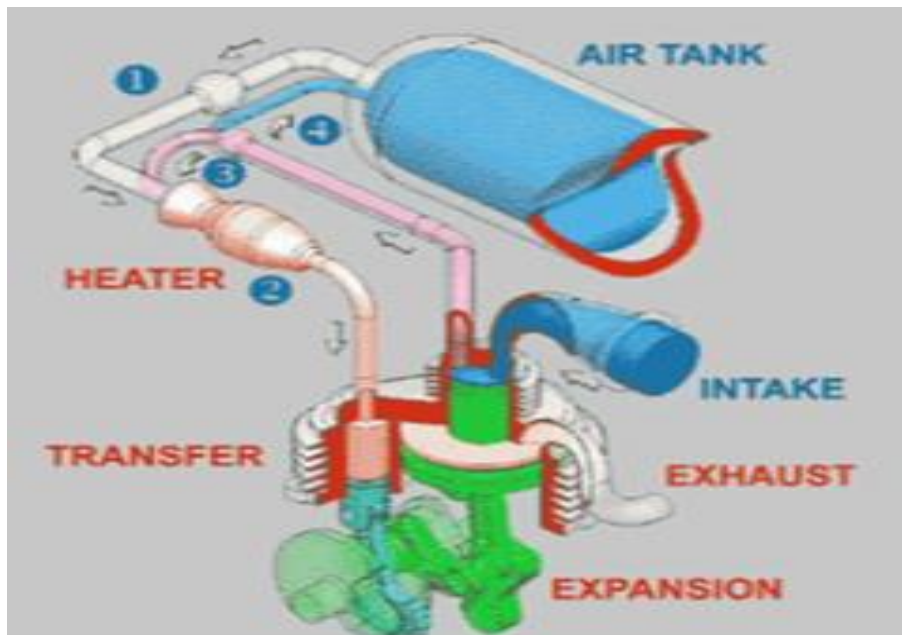


fig.4.Compressed Air Engine

ADVANTAGES:

In comparison to petrol- or diesel-powered vehicles “air powered vehicles” have following advantages:

- Air, on its own, is non-flammable, abundant, economical, transportable, storable and, most importantly, non-polluting.
- Compressed air technology reduces the cost of vehicle production by about 20%, because there is no need to build a cooling system, fuel tank, spark plugs or silencers.
- High torque for minimum volume.

- The mechanical design of the engine is simple and robust.
- Low manufacture and maintenance costs as well as easy maintenance.
- Lighter vehicles would mean less abuse on roads, thus, resulting in longer lasting roads.
- The price of fuelling air powered vehicles will be significantly cheaper than current fuels.
- When the air is being compressed at reasonable speeds, it heats up. The heat given off during compression could be reclaimed for space heating or water heating, or used in a Stirling engine.
- Transportation of the fuel would not be required due to drawing power off the electrical grid. This presents significant cost benefits. Pollution created during fuel transportation would be eliminated.

DISADVANTAGES:

- Very little is known about air powered vehicles thus far.
- Refuelling the compressed air container using a home or low-end conventional air compressor may take as long as 4 hours though the specialized equipment at service station may fill the tanks only in 3 min.
- Tanks get warm when they filled rapidly. It would be difficult to cool the tank efficiently while charging and thus it would either take a long time to fill the tank, or they would have to take less than a full charge (since heat drives up the pressure).
- Compressed air has a low energy density comparable to the values of electrochemical lead-acid batteries. While batteries can somewhat maintain their voltage throughout their discharge and chemical fuel tanks provide the same power densities from the first to the last litre, the pressure of compressed air tanks falls as air is drawn off.

Air pod, the Car That Runs on Air

With gas prices rising and the massive drought making ethanol a tough sell as a gas alternative, India's tata motors has hit on the perfect time to debut the Air pod, a small urban vehicle that, as its name suggests, runs on air. If you don't know much about how regular cars use fuel, natural gas or, alternatively, hydrogen is compressed in a pressurized tank, hence the 'pssf' sound when you unscrew the gas cap. Now think about air rifles. If you had the bad luck to grow up with an older brother obsessed with using you as a target (or perhaps you were that older sibling yourself), you know that the air we breathe seems harmless enough, but when compressed it packs a punch.



They enlisted the help of MDI, an engineering company that's been developing zero pollution engines since the early 90s. The Airpod has a 175 litre storage tank of compressed air that you refill with an external pump or with an electric motor that can 'refuel' the car while its in motion. This first model reaches a top speed of 43 mph (70 km/h), making it best suited for transporting people or small goods around city streets. One tank lasts over 125 miles (200 km) and takes only two minutes to fill up again at an average price of just one euro per fill. The Airpod has three seats for adults plus a smaller fourth seat for a child. There's even room for luggage. It only has three wheels, two doors and no steering wheel. Instead, you drive it with a joystick. MDI has the public and service sector in mind, naming runners, messengers and artisans as its target market. The Airpod, which is currently in its second phase of testing, is just one of five models MDI is developing. They're also working on a truck, sedan, convertible and bus version.



IV. CONCLUSION

Compressed air for vehicle propulsion is already being explored and now air powered vehicles are being developed as a more fuel-efficient means of transportation. Compressed air technology allows for engines that are both non-polluting and economical. After ten years of research and development, the compressed air vehicle will be introduced worldwide. Unlike electric or hydrogen powered vehicles, compressed air vehicles are not expensive and do not have a limited driving range. Compressed air vehicles are affordable and have a performance rate that stands up to current standards. To sum it up, they are non-expensive cars that do not pollute and are easy to get around in cities. On the whole, the technology is just about modifying the engine of any regular IC engine vehicle into an Air Powered Engine. The Air Powered Engine technology is cheaper in cost and maintenance, can be easily adapted by the masses and it doesn't cause any kind of harm to the environment. Instead, its wide spread use will help mankind in controlling the serious problem of global warming.

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